SALINITY TOLERANCE AND DISCRIMINATION IN HOUSE SPARROWS (*PASSER DOMESTICUS*)

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Workers interested in water use by landbirds have indicated the need for more data, from a wider variety of species, concerning various physiological tolerances and abilities pertinent to this problem (Bartholomew and Cade, Auk 80:504, 1963; Dawson et al., Auk 82:606, 1965). In light of its ubiquitous distribution and remarkable adaptive success, it was thought that experiments with the House Sparrow (*Passer domesticus*) would be worthwhile in that the data collected would reflect upon some of these important physiological mechanisms in a highly successful species.

The experiments described below were carried out from 6 April 1967 to 8 August 1967. Four female and five male House Sparrows were used. These were captured between 4 April and 5 May 1967 near Utah State University, Logan, Utah.

The sparrows were kept in cages in an air-conditioned room at approximately 72°F. The relative humidity was not rigidly controlled but was fairly constant owing to the air conditioning system. Readings taken daily for eight days in May showed extremes of 35 per cent and 46 per cent. The lighting was supplied by fluorescent lamps, and the daily photoperiod was changed periodically to simulate the natural photoperiod. Food consisted of mixed seeds supplied ad libitum.

The first procedure consisted of providing two drinking dishes containing different solutions for a group of five birds. In the first experiment the birds were given a choice between tap water and 0.10 M NaCl. In the second experiment the birds had a choice between 0.10 M NaCl and 0.30 M NaCl solutions. After 44 hours in the first experiment the five birds collectively had drunk 71 ml of tap water and 8 ml of 0.10 M NaCl. In the second experiment, after 26 hours the five birds had drunk 44 ml of 0.10 M NaCl and 5 ml of 0.30 M NaCl.

These experiments are sufficient to indicate clearly that House Sparrows are able to discriminate between salt solutions of different concentrations, and to choose the concentration that minimizes physiological stress. The preference for tap water over 0.10 M NaCl indicates an apparently greater refinement in salinity discrimination by House Sparrows than was found in Red Crossbills (*Loxia curvirostra*) by Dawson et al. (op. cit.).

In a second procedure a single NaCl solution was offered ad libitum and the birds were weighed daily. In the initial experiments the birds were offered NaCl solutions ranging from 0.10 M to 0.45 M. From the weight losses incurred by birds in these experiments the approximate tolerance level was judged to be about 0.30 M. Two female birds died in these first experiments during the second day on 0.35 M and 0.40 M NaCl, respectively. The first showed a 16 per cent weight loss, and the second a 13 per cent loss after one day on these solutions.

The seven remaining birds, in different sized groups, were offered NaCl solutions increasing at 0.01 M intervals from 0.29 M to 0.39 M. In these experiments it would seem that surviving birds were able to maintain their weight at a particular NaCl concentration. However, in some cases there was an initial decrease in weight followed by a leveling off. It is this decrease with a leveling off, along with the failure to return to its previous weight level when placed on tap water between experiments, that account for the greater percentage decrease in weight of the surviving bird on 0.38 M as compared with its decrease in weight on the lethal 0.39 M NaCl solution (table 1). Birds surviving a given concentration of NaCl were offered a solution of higher concentration. If serious weight loss had occurred at the previous concentration the birds were given tap water for one or more days. Thus, the concentration was gradually increased until all birds had reached a level at which they could not survive. All birds showed appreciable weight loss at the concentration that caused death. The results (table 1) indicate that there is a wide range (0.29 M to 0.39 M) of individual variation in salinity tolerance among House Sparrows.

Although the tolerance level for NaCl in the House Sparrow is within the range cited by Bartholomew and Cade (op. cit.) for seven species of land birds (including five subspecies of *Passerculus sandwichensis*) this level is high enough to suggest that it may have survival value when mildly saline solutions are the only drinking water available. Since the House Sparrow is closely dependent upon the availability of

TABLE 1. Effects of NaCl solutions on survival and body weight in House Sparrows.

Molar conc. NaCl	No. birds exposed ♂	No. birds exposed ♀	No. days on solution	No. birds surviving	No. birds dying	Day of death	Mean % weight change[a] survivors	Mean % weight change[a] non-survivors
0.29	4		9	3	1 (♂)	9	+2	−23
0.30	1	2	8	2	1 (♀)	7	−3	−23
0.31	2	1	10	3			−8	
0.32	2		7	2			−3	
0.33	4	1	8	3	2 (♀, ♂)	6, 8	+2	−26
0.34	3		7	3			−10	
0.35	3		7	2	1 (♂)	4	+2	−23
0.36	2		6	1	1 (♂)	3	−13	−19
0.37	1		7	1			−15	
0.38	1		7	1			−25	
0.39	1				1 (♂)	4		−19

[a] Calculated for survivors on the basis of the weight for the last day on a particular salt solution and the weight for the last day on tap water previous to being put on that salt solution. For non-survivors the last weight taken before death and the weight for the last day on tap water prior to death were used.

surface water (Bartholomew and Cade, op. cit.) it would not be surprising if its salt tolerance and its ability to discriminate between salt solutions of different concentrations actually function in promoting the biological success of the species. Whether this is actually the case will have to be shown by the results of future field studies.

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THE CANVASBACK, COMMON GOLDENEYE, AND BUFFLEHEAD IN ARCTIC ALASKA

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In Alaska, the Canvasback (*Aythya valisineria*) has been recorded north to Kotzebue Sound, 66° 45′ N, 163° 00′ W (Hansen, Condor 63:137, 1960); the Common Goldeneye (*Bucephala clangula*), north to "the lower reaches of the Porcupine" River (Gabrielson and Lincoln, Birds of Alaska, p. 191, 1959), the mouth of which lies at 66° 34′ N, 145° 19′ W; and the Bufflehead (*Bucephala albeola*), north, probably, to the village of Kobuk, 66° 55′ N, 156° 52′ W (Irving, U.S. Natl. Mus., Bull. 217:135, 1960). This paper reports the occurrences of these species in the central Brooks Range.

Canvasback. On 19 June 1958 I saw a flock of five adult male and female Canvasbacks on a lake one-half mile west of the John River at about 67° 9′ N, 151° 52′ W. The lake lies well within the forest, more than 55 air miles south southeast of the tree line in the John River valley. The ducks were closely observed, both in the air and on the water, with the aid of 8× binoculars.

Common Goldeneye. On 4 June 1963 Richard E. Morlan and I saw an adult female on the Koyukuk River, at Bettles Field (66° 55′ N, 151° 30′ W). On 10 June 1963 we saw an adult female on a lake beside the John River at the mouth of McKinley Creek (67° 24′ N, 152° 03′ W). On 13 June 1963 we found an adult male and an adult female on the John River at Threetime mountain (67° 14′ N, 151° 54′ W), and collected the female (*B. a. americana*, U.S. Natl. Mus. 529781). The largest egg follicle measured 6 mm. On 25 June 1963 we saw what appeared to be another adult female on the Alatna River at the mouth of Siruk Creek (66° 42′ N, 153° 18′ W). These several localities are in the forest; the northernmost, the mouth of McKinley Creek, lies 38 air miles south of the tree line in the John River valley.

Bufflehead. On 3 July 1956 I saw an adult male on a tundra pond beside the John River at about 68° 6′ N, 151° 52′ W. This locality is four air miles southwest of the summit of Anaktuvuk Pass. On 13 June 1961 William T. Stuart and I found an adult male and two adult females on a pond in the upper John River valley at about 68° 4′ N, 152° 00′ W, and collected the male (Peabody Mus. Nat. Hist. 8599). The testes measured 16 mm. On 19 June 1961 Joseph Mekiana and I flushed an adult female from a dense mat of dwarf birch (*Betula* sp.) beside the pond noted in the reference to 1956, above. Diving frequently, it refused to leave the water. A search for the nest was unsuccessful. On 8 June 1963 Morlan and I saw an adult male and an adult female on the Koyukuk River at Bettles Field. With the exception of Bettles Field, the localities where Buffleheads were observed are north of the forest; the southernmost lies 11 air miles northeast of the tree line in the John River valley.

On the above evidence, one may conclude that the Common Goldeneye and the Bufflehead probably breed in the central Brooks Range. Because the Nunamiut Eskimos have names for nearly all of the birds occurring within the limits of their present and recent territory (Irving, op. cit.), and because they do not recognize the three species noted here, one may further conclude that their occurrences in the central Brooks Range may represent recent, northward range extensions.

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SUBSPECIFIC STATUS OF *BRANTA CANADENSIS* IN THE CENTRAL BROOKS RANGE, ALASKA

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Kessel and Cade (Biol. Papers Univ. Alaska 2:31–32, 1958) assign Canada Geese of the Colville River, north Alaska, to *B. c. taverneri*, remarking that on the Colville this race equals "*B. c. minima* in part of 5th edition A.O.U. Checklist; and *B. c. leucopareia* of Bailey, 1948." Irving (U.S. Natl. Mus., Bull. 217: 34–35, 1960) similarly assigns to *taverneri* the Canada Geese from Anaktuvuk Pass (on the central Brooks Range divide) and from the wooded Koyukuk and Alatna Rivers in the south-central Brooks Range.

Six Canada Geese which I collected at Anaktuvuk Pass, on the Alatna River, and on the wooded John River, south of Anaktuvuk Pass, also represent *taverneri*. However, on 7 July 1961 at 68° 30′ N, 149° 57′ W on the upper Itkillik River, north-central Brooks Range, I took a nonbreeding adult male of the race *parvipes* (Yale Peabody Mus. 8596), from a flock of five adults. This bird, while not particularly fat, weighed 3202 g. The Itkillik River specimen of *B. c. parvipes* was appreciably heavier and larger than the adults and subadults of *B. c. taverneri* collected by me and reported by Kessel and Cade (op. cit.) and Irving (op. cit.) from the localities noted.

On 18 June 1963 Richard E. Morlan and I closely